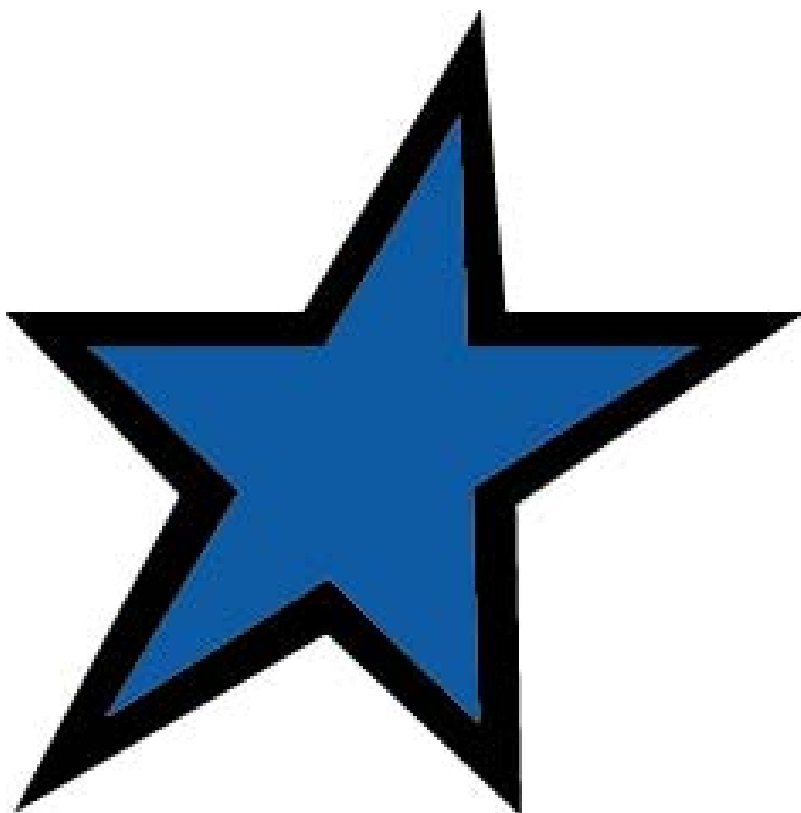

BLUE STAR

Power Systems Inc.

Submittal

12/22/2021

Project Title	Central States Diesel Generators - 750kW Paralleled 12-22-21
Quote Number:	0071630-5
Model:	PD750-01



Blue Star Power Systems Inc.
Taylor Wallace
2250 Carlson Drive
North Mankato MN 56003
Office: 507 345 1776
Cell: 507 317 9278
Email: taylor.wallace@bluestarps.com

BLUE STAR

Power Systems Inc.

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- 27 Industrial Batteries
- 24 BC2405A Series Battery Chargers
- 21 Sub-Base Fuel Tanks
- 47 Factory Load Test
- 2yr 2000hr limited warranty

BLUE STAR

Power Systems Inc.

Sales Quote

Quote Date: 12/22/2021 10:54:51 AM
Quote Number: 0071630-5
Project Title: Central States Diesel Generators - 750kW Paralleled 12-22-21
Prepared for: Blue Star Power Systems Inc.

Unit Model	PD750-01	Standby / Prime	Emergency Stationary Standby
kWe Rating	750 kWe	UL 2200 Listed	Yes
Fuel	Diesel	CSA Approved	Yes
EPA	Tier 2	Paint Color	White

Engine Model: Perkins 2806C-E18TTAG7 750kW Standby Power Rating at 1800 RPM Governor - Electronic Isochronous

Voltage: 480/277V 3 Phase 60 Hz 0.8 PF

Gen Model: Stamford S6L1D-C 12 Lead Wired 480V 3 Phase High Wye 125°C Rise Over 40°C Ambient

Voltage Regulator: Stamford MX321 Automatic Voltage Regulator with PMG Excitation

Control Panel: Blue Star DSE8610 Microprocessor Based Gen-Set Controller Mounted Facing Left from Generator End (Unless Specified Otherwise)
Standard Features: Low Oil Pressure, High Coolant Temp, Overspeed, Overcrank Shutdowns
Emergency Stop Pushbutton, Audible Alarm Buzzer with Silencing Switch

Control Panel Options: Low Water Level Sensor with Shutdown

Unit Color: White

Enclosure: Level 2 (Weather Proof Enclosure with Foam) Powder Coated 14 Gauge Steel Rugged and Durable 200 MPH Wind Rated Enclosure
Pitched Roof for Increased Structural Integrity and Improved Watershed
Punched Intake with Baffle and Punched Exhaust Openings
Keyed Alike Lockable Doors with Draw Down Latches and Stainless Steel Component Hinges
Additional 1.5" Thick Polydamp Type D Acoustical Foam (PAF)
Structural Steel Base with Mounting and Lifting Holes
Includes Pad Type Vibration Mounts to Isolate Unit from Mounting Surface

Sound Attenuation Foam: Sound Attenuation Installed in Enclosure

Enclosure Options:

Cooling: Unit Mounted Radiator (50°C Ambient)

Oil Drain Extension: Plumbed to Bulkhead Fitting in Base

Mainline Breaker: 1200 Amp 3 Pole 600 Volt Breaker Mounted & Wired in a NEMA 1 Enclosure

Jacket Water Heater: Engine Block Heater 5000W 240VAC Rated for -20°F
Heater Installed with Isolation Valves and Wired to Terminal

Air Cleaner: Dry Single Stage

Air Restrictor Indicator: Installed in Air Filtration System

Silencer: Critical Grade Compact (CPJ Series) Silencer Mounted to Engine

Battery: 24 Volt System with Rack and Cables

Battery Charger: 24 Volt 5 Amp Mounted and Wired to Terminal

Fuel Tank: 24 Hour / 1300 Gallon UL 142 Listed Sub-Base Fuel Tank with Stub-up Area
Double Wall Construction with Secondary Containment Standard
Includes: Supply & Return Connections, Fuel Level Gauge, Fuel Leak Switch and Fill & Vent Plumbing

Factory Test: Standard Commercial Testing Includes:
Verification of Alarm Shutdowns, Voltage Settings, Block Loading to Rated kWe and PF

Owner's Manual: Print Copy (Qty 1) **Standard**, Electronic Copy

Warranty: 2 Year / 2000 Hour Limited

Notes: Paralleling Application includes - Upgrade to motorized circuit breaker and factory testing

**Additional Options
(Not Included in Price):**

Payment Terms: Due Upon Receipt

Delivery Schedule: 26-30 Weeks (Contingent on component availability)

Terms & Conditions

- This quote is valid for a period of 15 days.
 - This proposal is our interpretation of your requirement. It includes only the items listed on this quotation. Should there be other requirements or specifications, we will re-quote accordingly.
 - Units are shipped wet to include lube oil and 50/50 water and antifreeze mix unless otherwise noted in this quotation.
 - All extended piping, wiring, or other than listed above is performed by "others".
 - Seller is not quoting, offloading, job site startup, personnel instructions, field testing, or unit installation.
 - Quoted prices include normal testing, packaging, and instructional literature.
 - It is the distributor/purchaser and end user's responsibility to ensure that this equipment is operated in accordance with all applicable local, state, and federal laws and regulations governing the use and operation of this equipment.
-

Distributor Terms & Conditions

BLUE STAR

Power Systems Inc.

Diesel Product Line

208-600 Volt

PD750-01

60 Hz / 1800 RPM

750 kWe

Standby

Ratings

	208V	240V	480V	600V
Phase	3	3	3	3
PF	0.8	0.8	0.8	0.8
Hz	60	60	60	60
Generator Model	S6L1D-D	S6L1D-D	S6L1D-C	S6L1D-C
Connection	12 LEAD WYE	12 LEAD DELTA	12 LEAD WYE	4 LEAD WYE
kWe	750	750	750	750
AMPS	2605	2258	1129	903
Temp Rise	125°C / 40°C	125°C / 40°C	125°C / 40°C	125°C / 40°C

Standard Equipment

Engine

- Radiator Cooled Unit Mounted (50°C)
- Radiator Duct Flange (OPU Only)
- Blower Fan & Fan Drive
- Starter & Alternator
- Oil Pump & Filter
- Oil Drain Extension w/Valve
- Governor - Electronic Isochronous
- 24V Battery System & Cables
- Air Cleaner (Dry Single Stage)
- Critical Grade Silencer Mounted
- Flexible Fuel Connector
- EPA Certified Tier 2

Generator

- Brushless Single Bearing
- Automatic Voltage Regulator
- ± 0.50% Voltage Regulation
- 4 Pole, Rotating Field
- 125°C Standby Temperature Rise
- 100% of Rated Load - One Step
- 5% Maximum Harmonic Content
- NEMA MG 1, IEEE and ANSI Standards Compliance for Temperature Rise

Additional

- Single Source Supplier
- UL 2200 & cUL Listed
- CSA Certified
- Seismic Certified to IBC 2021
- NFPA 110 / CSA C282 Compliant
- Microprocessor Based Digital Control Panel Mounted in NEMA 12 Enclosure
- Base - Structural Steel
- Main Line Circuit Breaker Mounted & Wired
- Battery Charger 24V 5 Amp
- Jacket Water Heater 5000W 240V w/Isolation Valves
- Vibration Isolation Mounts (Pad Type)
- 2 Year / 2000 Hour Standby Warranty
- Standard Colors - White / Gray

Application Data

Engine

Manufacturer:	Perkins	Displacement - Cu. In. (lit):	1,105 (18.1)
Model:	2806C-E18TTAG7	Bore - in. (cm) x Stroke - in. (cm):	5.71 (14.5) x 7.20 (18.3)
Type:	4-Cycle	Compression Ratio:	14:1
Aspiration:	Turbo Charged, CAC	Rated RPM:	1800
Cylinder Arrangement:	6 Cylinder Inline	Max HP Stby (kW _m):	1,101 (821)

Exhaust System

Standby

Gas Temp. (Stack): °F (°C)	918 (492)
Gas Volume at Stack Temp: CFM (m ³ /min)	5,866 (166)
Maximum Allowable Exhaust Restriction: in. H ₂ O (kPa)	40.0 (10.0)

Cooling System

Ambient Capacity of Radiator: °F (°C)	122 (50.0)
Maximum Allowable Static Pressure on Rad. Exhaust: in. H ₂ O (kPa)	0.50 (0.12)
Water Pump Flow Rate: GPM (lit/min)	128 (485)
Heat Rejection to Coolant: BTUM (kW)	13,086 (229)
Heat Rejection to CAC: BTUM (kW)	16,229 (284)
Heat Radiated to Ambient: BTUM (kW)	14,877 (260)

Air Requirements

Aspirating: CFM (m ³ /min)	2,509 (71.0)
Air Flow Required for Rad. Cooled Unit: CFM (m ³ /min)	31,767 (899)
Air Flow Required for Heat Exchanger/Rem. Rad. CFM (m ³ /min)	Consult Factory For Remote Cooled Applications

Fuel Consumption

At 100% of Power Rating: gal/hr (lit/hr)	54.3 (205)
At 75% of Power Rating: gal/hr (lit/hr)	43.0 (163)
At 50% of Power Rating: gal/hr (lit/hr)	30.2 (114)

Fluids Capacity

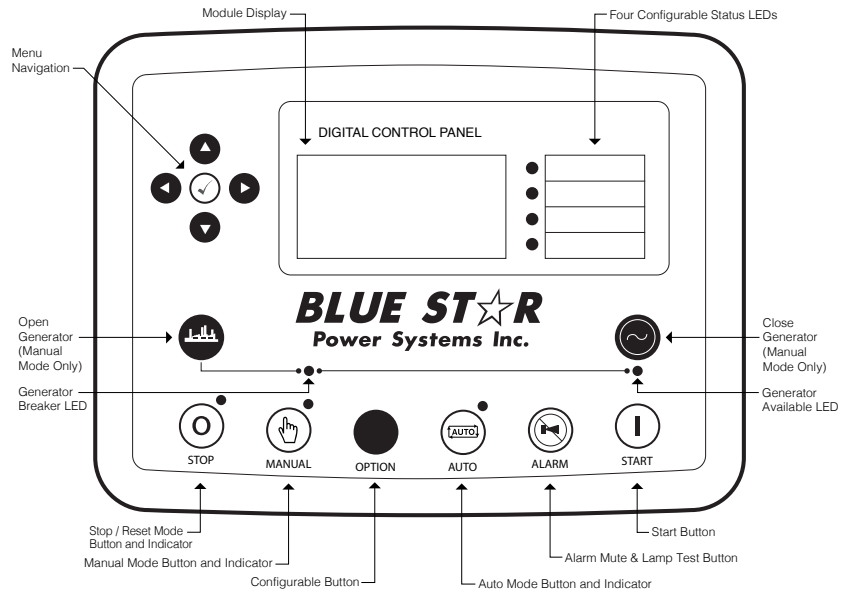
Total Oil System: gal (lit)	18.0 (68.0)
Engine Jacket Water Capacity: gal (lit)	5.49 (20.8)
System Coolant Capacity: gal (lit)	29.1 (110)

Deration Factors: Rated Power is available up to 1640 ft (500 m) at ambient temperatures to 86°F (30°C). Consult factory for site conditions above these parameters.

DCP7310 Control Panel

Standard Features

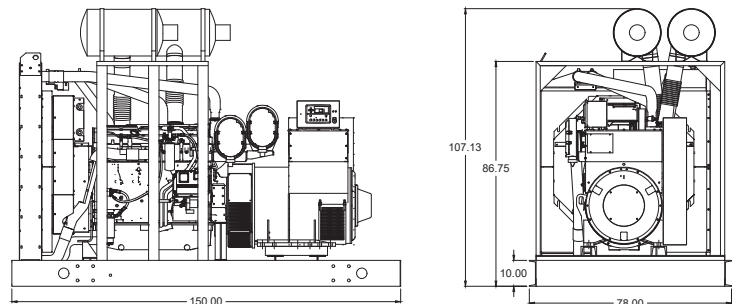
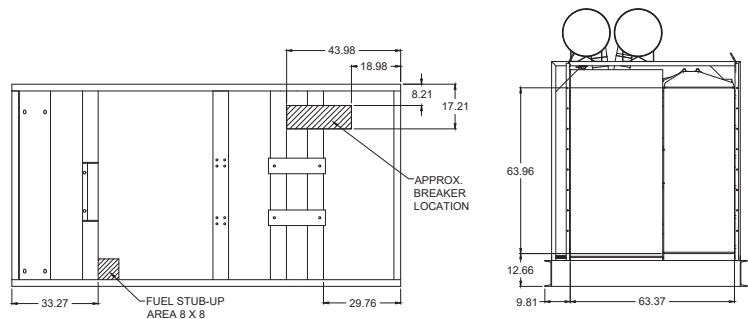
- Digital Metering
- Engine Parameters
- Generator Protection Functions
- Engine Protection
- CAN Bus (J1939) ECU Communications
- Windows-Based Software
- Multilingual Capability
- Remote Communications to DSE2548 Remote Annunciator
- 8 Programmable Contact Inputs
- 10 Contact Outputs
- RS485 Communicator Interface
- cULus Listed, CE Approved
- Event Recording
- IP 65 rating (with supplied gasket) offers increased resistance to water ingress
- NFPA 110 Level 1 Compatible



Weights / Dimensions / Sound Data

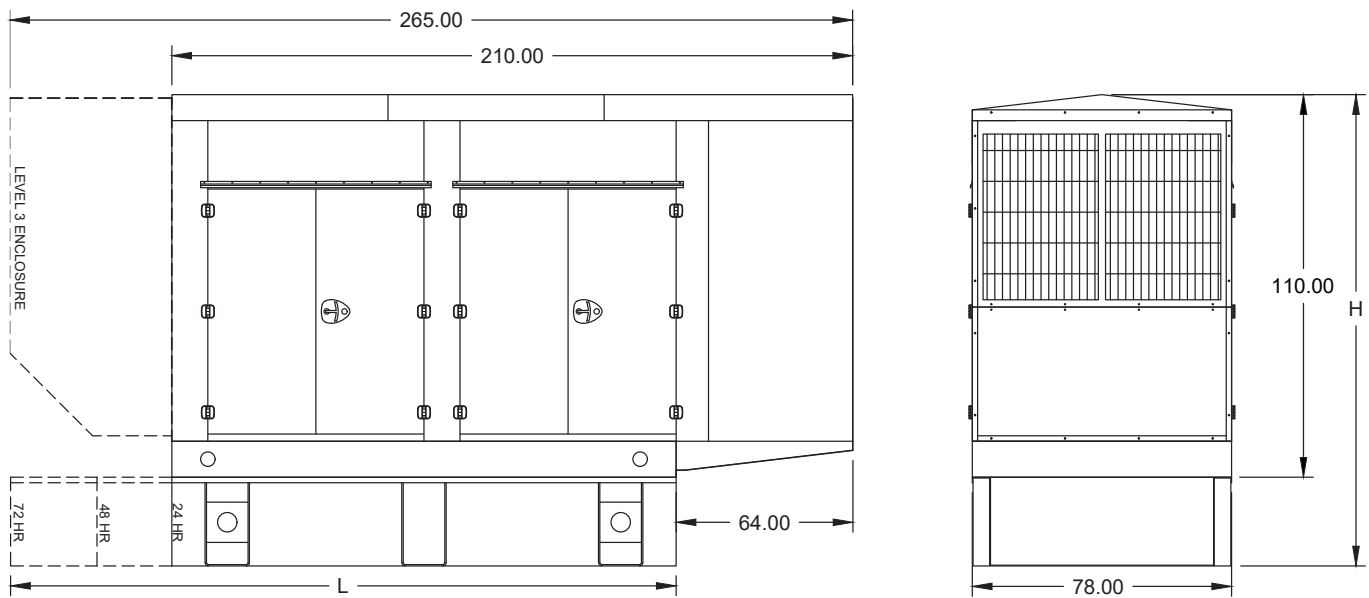
	L x W x H	Weight lbs
OPU	150 x 78 x 108 in	12,200
Level 1	210 x 78 x 110 in	14,100
Level 2	210 x 78 x 110 in	14,175
Level 3	265 x 78 x 110 in	14,675

Please allow 6-12 inches for height of exhaust stack.



*Please consult factory for 208V & 240V 3 Phase Drawings

Enclosures & Fuel Tanks



*Please consult factory for 208V & 240V 3 Phase Drawings

- All enclosure models are 200 MPH wind rating certified in accordance with IBC2021 and ASCE/SEI 7-16 standards.
- Level 2 & 3 enclosures include sound attenuation foam
- Level 3 enclosure includes frontal sound & exhaust hood.
- Enclosure height does not include exhaust stack.

	24 Hour 1300 Gallon	48 Hour 2600 Gallon	72 Hour 4000 Gallon
L	150.00	300.00	420.00
H	146.00	146.00	146.00

Notes

- All specification sheet dimensions are represented in inches.
- All drawings based on standard 480 volt standby generator. Lengths may vary with other voltages. All drawings and dimensions subject to change without notice.
- All enclosures and fuel tanks are based on the standard unit configuration. Any requested deviation can change dimensions.
- Sound data is measured at 23 feet (7 meters) in accordance with ISO 8528-10.
- All materials and specifications subject to change without notice.

American Owned



American Made

Blue Star Power Systems, Inc.

2250 Carlson Drive

North Mankato, Minnesota 56003

Phone + 1 507 345 1776

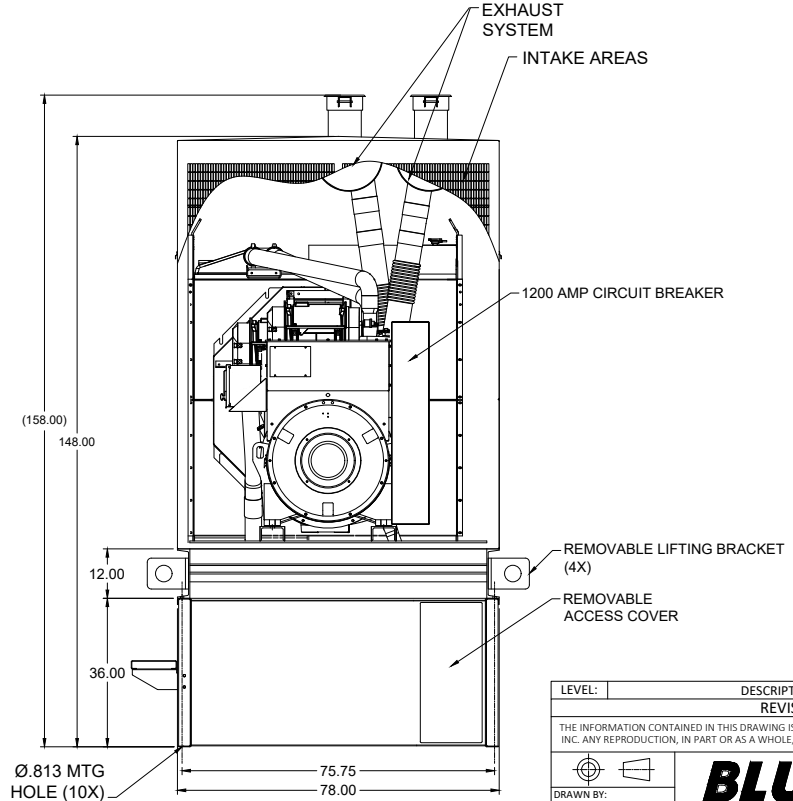
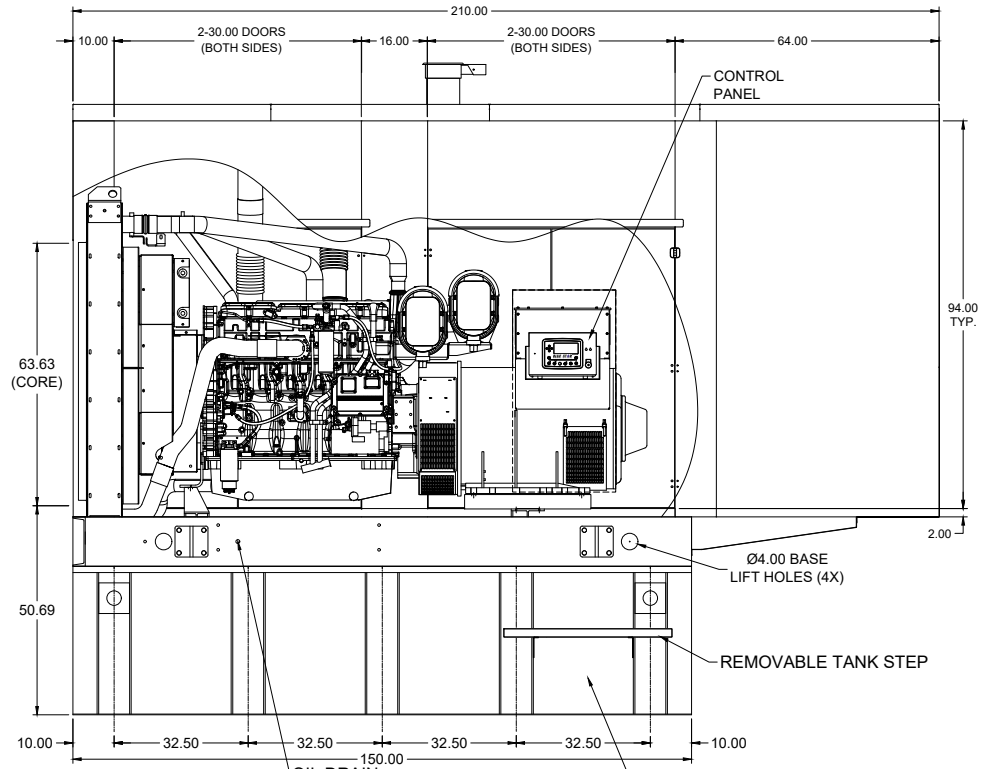
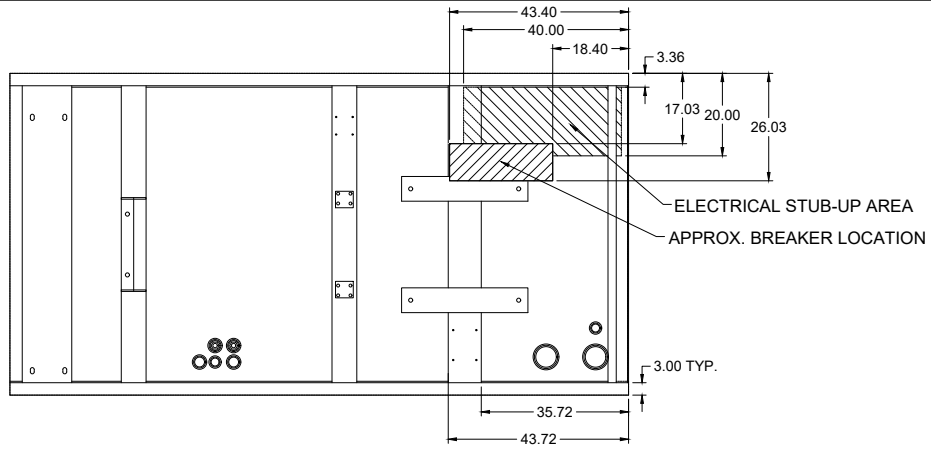
bluestarps.com

quote.bluestarps.com

sales@bluestarps.com

DRAWING: PD750-01-122-01

APPROXIMATE SHIP WEIGHT:
18,400 LBS.



- NOTES:
1. BREAKER DIMENSIONS ARE APPROXIMATE
2. RADIATOR CORE WIDTH: 64.25"
3. FUEL SUPPLY: 3/8" FUEL RETURN: 1/4"
4. SOUND ATTENUATION FOAM INCLUDED LEVEL 2 & 3 ENCLOSURES ONLY
5. (XX.XX) DIMENSIONS ARE FOR REFERENCE ONLY

1300GL DW UL LISTED
SUB-BASE FUEL TANK
W/STUB-UP AREA

LEVEL:	DESCRIPTION:	DATE:	BY:
REVISIONS:			
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF BLUE STAR POWER SYSTEMS, INC. ANY REPRODUCTION, IN PART OR AS A WHOLE, WITHOUT THE WRITTEN PERMISSION IS PROHIBITED.			
BLUE STAR Power Systems Inc.		2250 CARLSON DRIVE, NORTH MANKATO, MINNESOTA 56003 1 507 345 1776	
DRAWN BY: JDE	ENGINE: 2806C-E18TTAG7	BASE: 29400 (2-0800)	TANK: 23585(3-1129)
DATE: 10/21/2022	GENERATOR: S6L1D-C	HSG: WPE-107	SIZE: B
		SCALE: NONE SHEET: 1 OF 1	

2806C-E18TTAG7

2800

821 kWm (Gross) @ 1800rpm

Series

Basic technical data

Number of cylinders	6
Cylinder arrangement	Vertical inline
Cycle	4 stroke
Induction system	Turbocharged, air-to-air charge cooling
Compression ratio	14:1
Bore	145 mm
Stroke	183 mm
Displacement	18.1 litres
Direction of rotation (when viewed from flywheel)	Counter clockwise
Firing order (number 1 cylinder furthest from flywheel)	1, 5, 3, 6, 2, 4

Weight of ElectropaK

Dry (estimated)	2361 kg
Wet (estimated)	2477 kg

Overall dimensions, ElectropaK

Height	2126 mm
Length	2538 mm
Width	1691 mm

Centre of gravity, ElectropaK

Forward from rear of block (dry)	607 mm
Above crankshaft centre line (dry)	238 mm

Moments of inertia

Engine rotational components	1.67 kgm ²
Flywheel	1.92 kgm ²

Cyclic irregularity for engine standby power

At 110%	0.201
---------	-------

Ratings

Steady state speed capability at constant load	<1.5%
--	-------

Performance

Average sound pressure level for bare engine Without inlet and exhaust at 1 metre	104.3 dB(A)
--	-------------

Note: All data based on operation to ISO 3046/1:2002 standard reference conditions.

Note: For engines operating in ambient conditions other than the standard reference conditions stated below, a suitable derate must be applied.

Note: Derate tables for increased ambient temperature and/or altitude are available, please contact Perkins Applications Department.

Test conditions

Air temperature	25°C
Barometric pressure	100 kPa
Relative humidity	30%
Air inlet restriction at maximum power (nominal)	5 kPa
Exhaust back pressure at maximum power (nominal)	8.5 kPa
Aftercooler restriction at maximum power (nominal)	12 kPa
Fuel temperature (inlet pump)	40°C
All ratings certified to within	±3%

General installation

Designation	Units	1800 rpm	
		Prime power (60 Hz)	Standby power (60 Hz)
Gross engine power	kWb	747	821
Gross BMEP	kPa	2776	3053
Mean piston speed	m/s	11	
ElectropaK nett engine power	kW	716	790
Engine coolant flow against 95 kPa restriction	litres/min	485	
Combustion air flow	kg/h	4607	4744
Combustion air flow (air inlet)	m ³ /min	69	71
Exhaust gas flow (maximum) at atmospheric pressure	m ³ /min	157	166
Exhaust gas temperature (turbo out maximum)	°C	469	492
Overall thermal efficiency	%	37	37
Typical generator set electrical output (0.8 pf 25°C)	kWe	680	750
	kVA	850	938
Assumed alternator efficiency	%	95	

Energy balance

Designation	Units	1800 rpm	
		Prime power (60 Hz)	Standby power (60 Hz)
Energy in fuel	kWt	2024	2211
Energy in power output (gross)	kWb	747	821
Energy to cooling fan	kWM	31.5	
Energy in power output (nett)	kWM	716	790
Energy to aftercooler	kWt	267	284
Energy to coolant and oil	kWt	210	229
Energy to radiation	kWt	124	137
Energy to exhaust	kWt	677	741

Cooling system

Total coolant capacity

ElectroPaK (with radiator)	109.5 Litres
ElectroPaK (without radiator)	20.8 Litres
Maximum top tank temperature	97°C
Maximum static pressure head on pump	125 kPa
Temperature rise across engine	3°C
Maximum permissible external system resistance (60Hz)	95 kPa
Thermostat operation range	81°C to 92°C

Radiator

Radiator face area	1.496 m ²
Material and number of rows	1 Row, Aluminium
Material and fins per inch	8.5
Width of matrix	1651 mm
Height of matrix	1610 mm
Pressure cap setting	103 kPa

Fan

Type	Pusher
Diameter	1142 mm
Number of blades	6
Material	Composite
Drive ratio (60 Hz)	0.8:1
Airflow at rated speed (60 Hz)	899 m ³ /min

Recommended coolant

Recommended coolant: 50% anti freeze/50% water.

For details of recommended coolant specifications, please refer to the Operation and Maintenance Manual (OMM) for this engine model.

Duct allowance

Maximum additional restriction to cooling airflow and resultant minimum airflow		
Ambient clearance 50% Glycol	Duct allowance (Pa)	m ³ /sec
60 (Hz)	60 (Hz)	60 (Hz)
51	125	15

Fuel system

Type of injection	Unit injection
Fuel injection pump	Not applicable
Fuel injector	MEUI
Nozzle opening pressure	38 MPa
Maximum particle size	2 microns
Fuel lift pump type	Mechanical
Flow	420 litres/hr
Pressure	700 kPa
Maximum suction head	27 kPa
Maximum static pressure head	3.7 m
Maximum fuel temperature at lift pump inlet	79°C
Maximum fuel filter service interval	500 hours
Governor type	Electronic
Speed control conforms to	ISO 8528-5 class G3 steady state

Fuel specification

USA Fed Off Highway

Europe Off Highway

Note: For further information on fuel specifications and restrictions, refer to the OMM fuels section for this engine model.

Fuel consumption

Power rating %	747 kWm @ 1800 rpm Prime	
	g/kWh	litres/hr
25	230	59
50	214	100
75	215	146
100	210	189
110	208	205

Cold start recommendations

Minimum battery cold cranking amps

Minimum starting temperature	Grade of engine lubrication oil	SAEJ537 Cold Cranking amps	Starting Aids
-0°C	15W-40	1400	None
-5°C	15W-40	1400	Jacket Water Heater to 45°C
-10°C	15W-40	1400	Jacket Water Heater to 45°C
-15°C	0W-30	1400	Jacket Water Heater to 45°C
-20°C	0W-30	1400	Jacket Water Heater to 45°C
-25°C	0W-30	1400	Jacket Water Heater to 45°C

Notes:

- for cable sizes see applications and installation manual
- jacket water heater needed below 0°C

Lubrication system

Total system capacity

Minimum oil capacity in sump	56.0 litres
Maximum oil capacity in sump	68.0 litres
Maximum oil temperature (continuous operation)	97°C
Maximum oil temperature (intermittent operation)	110°C

Lubricating oil pressure

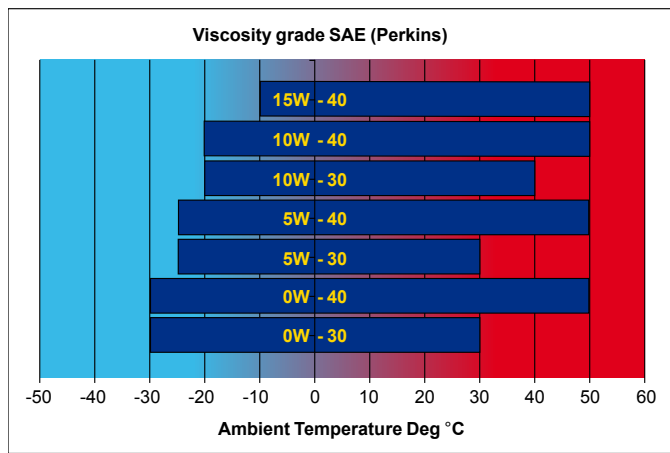
Relief valve opens	620 kPa
Minimum oil pressure	275 kPa
At maximum no-load speed	420 kPa
Oil flow at rated speed (1500 rpm)	209 litres/min

Maximum engine operating angles

Front up, front down, right side or left side	7°
---	----

Recommended SAE viscosity

A multigrade oil which conforms to API-CH4 must be used, see illustration below:



Induction system

Maximum air intake restriction

Clean filter	3.7 kPa
Dirty filter	6.2 kPa
Air filter type	Dry/paper

Exhaust system

Exhaust outlet size	139.7 mm
Minimum back pressure	Not applicable
Maximum back pressure	10 kPa

Electrical system

Alternator	50 amps/24 volts
Starter motor	9 kW/24 volts
Number of teeth on the flywheel	113
Number of teeth on starter pinion	12
Engine stop method	Ground switch

Engine mounting

Maximum static bending moment at rear face of block	287.9 Nm
---	----------

Load acceptance

The figures below comply with the requirements of classification 3 and 4 of ISO 8528-12 and G2 operating limits stated in ISO 8528-5.

Initial load application: When engine reaches rated speed (15 seconds maximum after engine starts to crank)		
Description	Unit	60 Hz
% of Prime power		49
Transient frequency deviation	%	10.00
Frequency recovery	sec	2.6

The figures shown in the table above were obtained under the following test conditions:

Engine block temperature	42°C
Ambient temperature	17°C
Governing mode	0%
Alternator inertia	10.41 kgm ²
Under frequency roll off (UFRO) point set to	59.8 Hz
LAM on/off	Off

All tests were conducted using and engine installed and services to Perkins Engines Company Limited recommendations.

Blue Star Power Systems, Inc. utilizes the highest quality alternators available. Our industrial alternators provide consistent performance, quality design, and great durability required for long life and versatility. Alternators used by Blue Star Power Systems, Inc. are UL and CSA Listed, which guarantees that each one meets the rigorous demands of industrial power generation and will provide safe and effective service for the life of the alternator. Blue Star Power Systems, Inc. alternators range from 20 kWe through 2000 kWe.



Standard Features

- **Enhanced Ventilation**
Created by a high-efficiency fan that optimizes internal airflow patterns, maximizes heat transfer, and minimizes hot spot differentials for extended winding life.
- **Fully Guarded**
For operator safety and alternator protection. No rotating or electrically energized parts are exposed. All openings are covered by louvers or screens.
- **Large Conduit Box**
Provides ample space for easy connections and allows load line access from all sides, top, or bottom.
- **Design Specs and Agency Approvals**
All Blue Star Power Systems, Inc. alternators are UL and CSA Listed (unless specified otherwise) and meet NEMA MG1-32, BS5000, CSA C22.2, IEC 34 and VDE 0530 requirements.
- **Class H Insulation System**
Utilizes an unsaturated polyester varnish for optimal insulation life and superior moisture protection.
- **Optimized Windings**
Provide low reactances and exceptional motor starting capability. The stator windings utilize a 2/3 pitch to minimize harmonic distortion and facilitate parallel operation.
- **Permanent Magnet Generator (optional)**
Ensures 300% short circuit current during fault conditions and provides the regulator with input power isolated from load distortion.
- **Heavy-Duty Bearing**
Resists contamination and gives a life expectancy up to 40,000 hours.
- **Automatic Voltage Regulator**
Provides accurate 1% regulation, under-speed protection, stability adjustment to optimize transient performance, and EMI filtering to commercial standards. Fully encapsulated for rugged durability in virtually any environment.

STAMFORD®

S6L1D-C4 Wdg.311/312 - Technical Data Sheet

Standards

STAMFORD industrial alternators meet the requirements of the relevant parts of the IEC 60034 and the relevant sections of other international standards such as BS5000-3, ISO 8528-3, VDE 0530, NEMA MG1-32, CSA C22.2-100 and AS 60034. Other standards and certifications can be considered on request.

Quality Assurance

Alternators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.



Excitation and Voltage Regulators

Excitation System					
AVR Type	MX341	MX321/MX322	DECS100	DECS150	
Voltage Regulation	± 1%	± 0.5%	± 0.25%	± 0.25%	with 4% Engine Governing
AVR Power	PMG	PMG	PMG	PMG	

No Load Excitation Voltage (V)	14 - 12.9
No Load Excitation Current (A)	0.8 - 0.74
Full Load Excitation Voltage (V)	59
Full Load Excitation Current (A)	2.9
Exciter Time Constant (seconds)	0.17

STAMFORD

S6L1D-C4 Wdg.311/312

Electrical Data								
Insulation System	H							
Stator Winding	Double Layer Concentric							
Winding Pitch	2/3							
Winding Leads	12/6							
Winding Number	311/312							
Number of Poles	4							
IP Rating	IP23							
RFI Suppression	BS EN 61000-6-2 & BS EN 61000-6-4, VDE 0875G, VDE 0875N. Refer to factory for others							
Waveform Distortion	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
Short Circuit Ratio	1/Xd							
Steady State X/R Ratio	15.40							
	50 Hz				60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air Flow	1.46 m ³ /sec				1.76 m ³ /sec			
Voltage Series Star (V)	380	400	415	440	416	440	460	480
Voltage Parallel Star (V)*	190	200	208	220	208	220	230	240
Voltage Delta (V)	220	230	240	254	240	254	266	277
kVA Base Rating (Class H) for Reactance Values (kVA)	800	810	810	800	875	925	963	1000
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.62	2.39	2.22	1.95	2.86	2.71	2.58	2.46
X'd Dir. Axis Transient	0.19	0.17	0.16	0.14	0.20	0.19	0.18	0.17
X''d Dir. Axis Subtransient	0.15	0.14	0.13	0.11	0.17	0.16	0.15	0.14
Xq Quad. Axis Reactance	2.10	1.92	1.78	1.56	2.30	2.17	2.07	1.97
X''q Quad. Axis Subtransient	0.33	0.30	0.28	0.25	0.36	0.34	0.33	0.31
XL Stator Leakage Reactance	0.08	0.07	0.07	0.06	0.09	0.08	0.08	0.08
X2 Negative Sequence Reactance	0.07	0.07	0.06	0.05	0.08	0.08	0.07	0.07
X0 Zero Sequence Reactance	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.01
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.14	2.87	2.66	2.34	3.44	3.25	3.09	2.95
X'd Dir. Axis Transient	0.21	0.20	0.18	0.16	0.23	0.22	0.21	0.20
X''d Dir. Axis Subtransient	0.18	0.16	0.15	0.13	0.20	0.19	0.18	0.17
Xq Quad. Axis Reactance	2.16	1.97	1.83	1.61	2.36	2.23	2.13	2.03
X''q Quad. Axis Subtransient	0.40	0.36	0.34	0.30	0.44	0.41	0.39	0.38
XL Stator Leakage Reactance	0.09	0.08	0.08	0.07	0.10	0.09	0.09	0.08
Xlr Rotor Leakage Reactance	0.10	0.09	0.09	0.08	0.11	0.10	0.10	0.09
X2 Negative Sequence Reactance	0.09	0.08	0.07	0.07	0.10	0.09	0.09	0.08
X0 Zero Sequence Reactance	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02

* Parallel Star connection only available with 12 leads winding option

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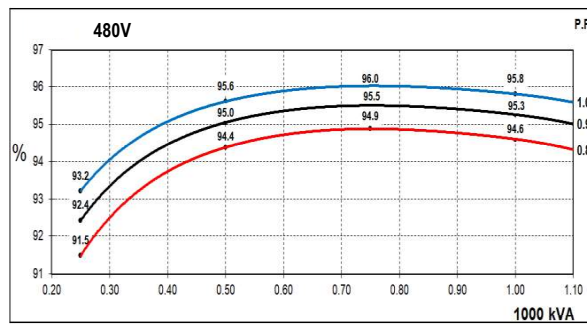
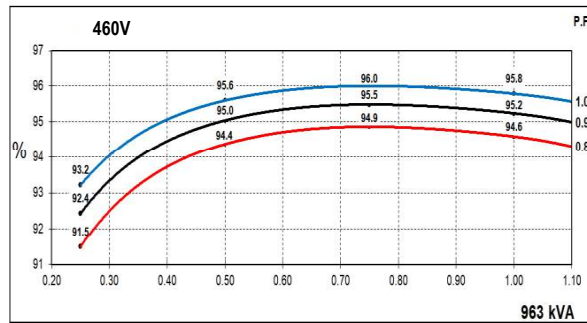
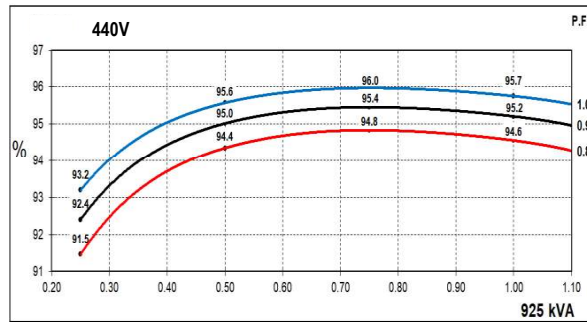
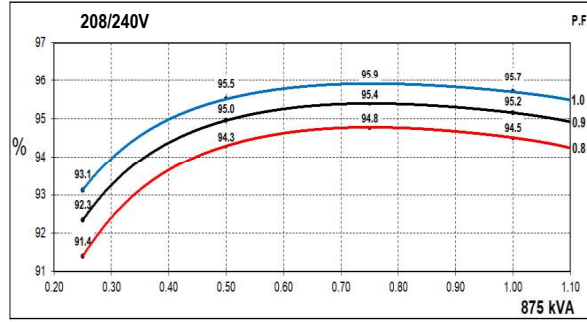
Time Constants (Seconds)		
T'd Transient Time Const.	0.092	
T''d Sub-Transient Time Const.	0.016	
T'do O.C. Field Time Const.	3.340	
Ta Armature Time Const.	0.020	
T''q Sub-Transient Time Const.	0.0095	
Resistances in Ohms (Ω) at 22 ^o C		
Stator Winding Resistance (Ra), per phase for series connected	0.00330	
Rotor Winding Resistance (Rf)	1.63	
Exciter Stator Winding Resistance	18.47	
Exciter Rotor Winding Resistance per phase	0.095	
PMG Phase Resistance (Rpmg) per phase	1.91	
Positive Sequence Resistance (R1)	0.0041	
Negative Sequence Resistance (R2)	0.0048	
Zero Sequence Resistance (R0)	0.0041	
Saturation Factors	400V	480V
SG1.0	0.367	0.359
SG1.2	1.52	1.304
Mechanical Data		
Shaft and Keys	All alternator rotors are dynamically balanced to better than ISO 21940-11 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.	
	1 Bearing	2 Bearing
SAE Adaptor	SAE0,1	SAE0,1
Moment of Inertia	16.455 kgm ²	15.93 kgm ²
Weight Wound Stator	803kg	803kg
Weight Wound Rotor	721kg	679kg
Weight Complete Alternator	1897kg	1970kg
Shipping weight in a Crate	1940kg	2013kg
Packing Crate Size	160x105x153(cm)	160x105x153(cm)
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	-	BALL 6224
Bearing Non-Drive End	BALL 6317	BALL 6317

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THREE PHASE EFFICIENCY CURVES

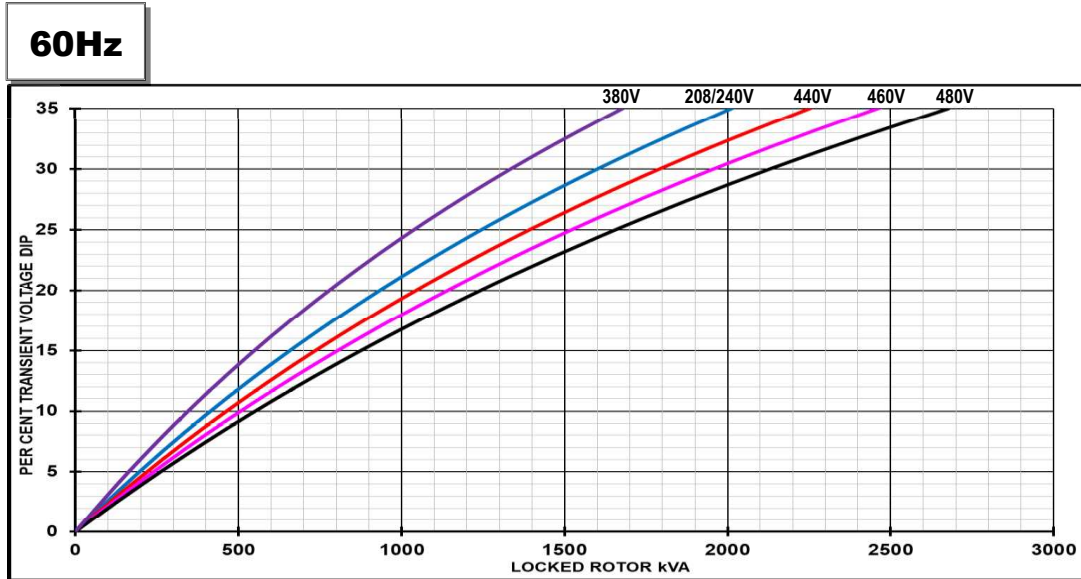
60Hz



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Locked Rotor Motor Starting Curves - Separately Excited



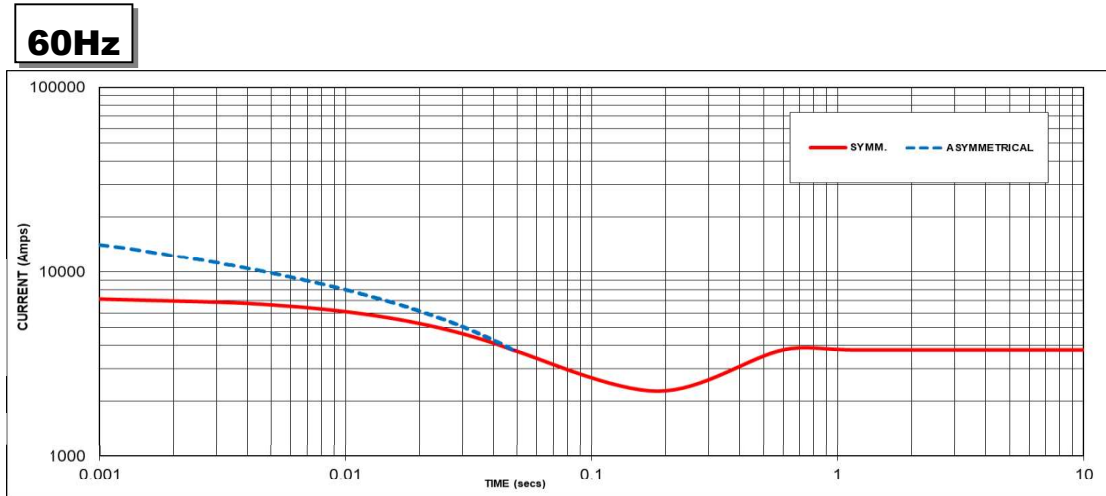
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor	
Lagging PF	Scaling Factor	Lagging PF	Scaling Factor
<= 0.4	1.00	<= 0.4	1.25
0.5	0.95	0.5	1.20
0.6	0.90	0.6	1.15
0.7	0.86	0.7	1.10
0.8	0.83	> 0.7	1.00
0.9	0.75		
0.95	0.70		
1	0.65		

Note: To determine % Transient Voltage Dip or Voltage Rise at various PF, multiply the % Voltage Dip from the curve directly by the Scaling Factor.

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S6L1D-C4 Wdg.311/312

Three-phase Short Circuit Decrement Curve - Separately Excited



Sustained Short Circuit = 3781 Amps

Note 1

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380V	X 1.00	416V	X 1.00
400V	X 1.07	440V	X 1.06
415V	X 1.12	460V	X 1.12
440V	X 1.18	480V	X 1.17

The sustained current value is constant irrespective of voltage level

If MX322 or digital AVR is used, the sustained short-circuit current value is to be multiplied by a factor of 1.1.

Note 2

The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

Note 3

All other times are unchanged

Curves are drawn for Star connections under no-load excitation at rated speeds. For other connection (where applicable) the following multipliers should be applied to current values as shown :

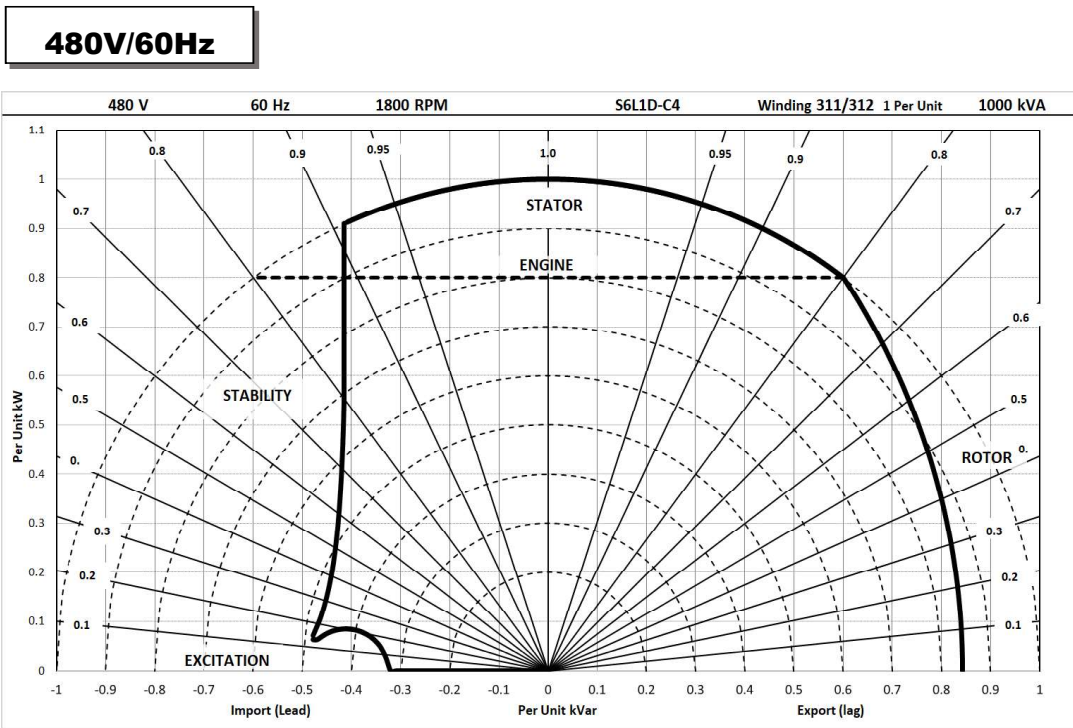
Parallel Star = Curve current value X 2

Series Delta = Curve current value X 1.732

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Typical Alternator Operating Charts



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RATINGS AT 0.8 POWER FACTOR

Class - Temp Rise		Standby - 163/27°C				Standby - 150/40°C				Cont. H - 125/40°C				Cont. F - 105/40°C			
60 Hz	Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel Star (V)*	208	220	230	240	208	220	230	240	208	220	230	240	208	220	230	240
	Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
	kVA	950	1000	1044	1088	913	969	1006	1044	875	925	963	1000	815	845	890	915
	kW	760	800	835	870	730	775	805	835	700	740	770	800	652	676	712	732
	Efficiency (%)	94.3	94.4	94.4	94.4	94.4	94.4	94.5	94.5	94.5	94.6	94.6	94.6	94.6	94.7	94.7	94.8
	kW Input	806	848	885	922	774	821	852	884	741	783	814	846	689	714	752	772

* Parallel Star connection only available with 12 leads winding option

De-rates

All values tabulated above are subject to the following reductions:

- 5% when air inlet filters are fitted
- 3% for every 500 meters by which the operating altitude exceeds 1000 meters above mean sea level
- 3% for every 5°C by which the operational ambient temperature exceeds 40°C @ Class H temperature rise (please refer to applications for ambient temperature de-rates at other temperature rise classes)
- For any other operating conditions impacting the cooling circuit please refer to applications

Note: Requirement for operating in an ambient exceeding 60°C and altitude exceeding 4000 meters (for <690V) or 1500 meters (for >690V) must be referred to applications.

Dimensional and Torsional Drawing

For dimensional and torsional information please refer to the alternator General Arrangement and rotor drawings available on our website (<http://stamford-avk.com/>)

Note: Continuous development of our products means that the information contained in our data sheets can change without notice, and specifications should always be confirmed with Cummins Generator Technologies prior to purchase.

MX321 Voltage Regulator



MX321 is a three phase sensed Automatic Voltage Regulator and forms part of the excitation system for a brush-less generator. Excitation power is derived from a three-phase permanent magnet generator (PMG), to isolate the AVR control circuits from the effects of nonlinear loads and to reduce radio frequency interference on the generator terminals. Sustained generator short circuit current is another feature of the PMG system.

Voltage Adjustment

The screwdriver adjustable potentiometer adjusts the generator output voltage. Adjustment clockwise increases the generator output voltage.

When using a remote voltage adjust rheostat, remove the jumper wire across terminals 1 and 2 and install a 1k ohm 1 watt rheostat. This will give $\pm 10\%$ voltage variation from the nominal.

Stability Adjustment

The AVR includes a stability or damping circuit to provide good steady state and transient performance of the generator.

A jumper link selector is provided to optimize the response of the stability circuit to various size generators. The link should be positioned as shown in the diagram according to the kW rating of the generator.

The correct setting of the Stability adjustment can be found by running the generator at no load and slowly turning the stability control anti-clockwise until the generator voltage starts to become unstable.

The optimum or critically damped position is slightly clockwise from this point (i.e. where the machine volts are stable but close to the unstable region).

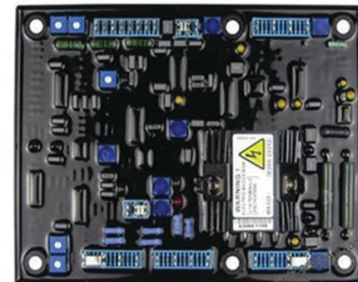
Under Frequency Roll Off (UFRO) Adjustment

The AVR incorporates an underspeed protection circuit which gives a volts/Hz characteristic when the generator speed falls below a presettable threshold known as the "knee" point.

The red Light Emitting Diode (LED) gives indication that the UFRO circuit is operating.

The UFRO adjustment is preset and sealed and only requires the selection of 50 or 60Hz and 4 pole or 6 pole, using the jumper link as shown in the diagram.

For optimum setting, the LED should illuminate as the frequency falls just below nominal, i.e. 47Hz on a 50Hz system or 57Hz on a 60Hz system.



Specifications

Sensing Input

Voltage	190 to 264VAC max, 1 or 3 phase
Frequency	50 to 60 Hz Nominal

Power Input (PMG)

Voltage	170 to 220VAC, 3 phase
Current	3A
Frequency	100 to 120 Hz Nominal

Output

Voltage	max 120VDC
Current	Continuous 3.7A Intermittent 6A for 10 secs
Resistance	15 ohms Minimum

Regulation $\pm 0.5\%$ RMS

Thermal Drift 0.02% per 1°C change in AVR ambient

Soft Start Ramp Time 0.4 - 4 seconds

Typical System Response

AVR Response	10 ms
Field Current to 90%	80 ms
Machine Volts to 97%	300 ms

External Voltage Adjustment $\pm 10\%$ with 1k ohm 1 watt trimmer

Under Frequency Protection

Set Point	95% Hz
Slope	100 to 300% down to 30 Hz
Max. Dwell	20% volts/S Recovery

Unit Power Dissipation 18 watts Maximum

Analog Input

Maximum Input	± 5 VDC
Sensitivity	1V for 5% Generator Volts (Adjustable)
Input Resistance	1k ohm

Quadrature Droop Input 10 ohms Burden

Max. Sensitivity	0.22A for 5% Droop 0PF
Max. Input:	0.33A

Current Limit Input 10 ohms burden

Sensitivity Range	0.5 to 1A
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Over Voltage Detection Input 10 ohms Burden

Set Point	300V Time Delay: 1 sec (Fixed)
CB Trip Coil Volts	10 to 30VDC
CB Trip Coil Resistance	20 to 60 ohms
Time Delay	1 second (Fixed)

Over Excitation Protection

Set Point	75VDC
Time Delay	8 to 15 seconds (Fixed)

DSE8610 Control Panel



The DSE8610 MKII is an easy to use Synchronising Auto Start Control Module suitable for use in a multi-generator loadshare system, designed to synchronize up to 32 generators including electronic and non-electronic engines.

The DSE8610 MKII monitors the generator and indicates operational status and fault conditions, automatically starting or stopping the engine on load demand or fault condition.

Key Load Share Features

- Peak lopping/sharing (with appropriate DSE mains controller)
- Sequential set start
- Manual voltage/frequency adjustment
- R.O.C.O.F. and vector shift protection
- Generator load demand
- Automatic hours run balancing
- Mains (Utility) decoupling
- Mains (Utility) decoupling test mode
- Dead bus sensing
- Bus failure detection
- Direct governor and AVR control
- Volts and frequency matching
- kW and kVA load sharing
- Dead bus synchronising
- cULus Listed

Key Features

- Comprehensive synchronising & loadsharing capabilities
- Built in governor and AVR control
- Base load (kW export) control
- Positive & negative kVA export control
- Mains (Utility) decoupling protection
- 4-Line back-lit LCD text display
- DSENet expansion compatibility
- Fully configurable via PC using USB, RS232, RS485 & Ethernet communication
- 3 phase generator sensing and protection
- Generator current and power monitoring (kW, kVA, pf)
- Breaker control via fascia buttons
- Fuel and start outputs configurable when using CAN
- 8 configurable DC outputs
- 2 configurable volt-free relay outputs
- 4 configurable analog/digital inputs
- Built in sensors to support 0V to 10V & 4mA to 20mA
- 12 configurable digital inputs
- Configurable 5 stage dummy load and load shedding outputs
- Simultaneous use of all communication ports
- Remote SCADA monitoring via various DSE software applications
- MODBUS RTU & TCP support with configurable MODBUS pages for integration into building management systems (BMS)
- Advanced SMS messaging (additional external modem required)
- Start & stop capability via SMS messaging
- 3 configurable maintenance alarms
- Uses DSE Configuration Suite PC Software for simplified configuration
- Increased input and output expansion capability via DSENet®
- IP65 rating (with supplied gasket) offers increased resistance to water ingress



Specifications

DC Supply

Continuous Voltage Rating	8V to 35V Continuous
Cranking Dropouts:	Able to survive 0V for 100mS, providing supply was at least 10V before dropout and supply recovers to 5V. This is achieved without the need for internal batteries.
Maximum Operating Current	530mA at 12V, 280mA at 24V
Maximum Standby Current	320mA at 12V, 160mA at 24V
Charge Fail/Excitation Range	0V to 35V

Outputs

Output A (Fuel)	15ADC at Supply Voltage
Output B (Start)	15ADC at Supply Voltage
Outputs C & D (Volt Free)	8AAC at 250VAC
Aux Outputs E to L	2ADC at Supply Voltage

Generator & Bus

Voltage Range (L-L)	26V to 719VAC
Voltage Range (L-N)	15V to 415VAC
Frequency Range	3.5 Hz to 75 Hz

Built in AVR Governor Control

Minimum Load Impedance	500 ohms Fully Isolated
Gain Voltage	0V to 10VDC Fully Isolated
Offset Voltage	0V to 10VDC Fully Isolated

Magnetic Pickup

Voltage Range	+/- 0.5V to 70V
Frequency Range	10,000 Hz (max)

Display

LCD Heated Display	-40°F to 158°F
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Generator Set

Blue Star Power Systems, Inc. completely paints all of its generator sets in our state-of-the-art downdraft paint booth. It begins with an extensive cleaning of the unit through sanding and a full wipe down using an alkaline-based cleaner. Once completely clean, the unit is then painted with Cardinal Industrial Semigloss paint. Electrostatic paint equipment ensures correct and even coverage. The unit then receives a complete covering of Cardinal Industrial Clear Coat in a hammer texture to provide extra protection and a durable long-lasting easy-to-clean finish.

Performance Characteristics

- 3.0+ Mils TDFT
- Xenon Arc 1100 hours - Excellent Weatherability
- 1000 Hour Salt Spray - Over Primer - Passed (3.0 Mils Total TDFT)
- Adhesion, Crosshatch - 5B
- Gloss 90+ @ 60°

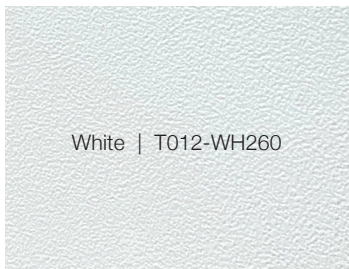
Generator Set Enclosure

Blue Star Power Systems, Inc. provides Cardinal Industrial Hammer Textured Semi-Gloss Polyester Powder Coating as standard on all our enclosures. Long term exterior durability, high performance mechanical properties and high gloss are standard characteristics of Cardinal Powder Coating. Cardinal TGIC Polyester Coating exceeds UL 2200 & CSA requirements.

Performance Characteristics

- Cured Powder Properties 2.0+ Mils DFT
- PCI Powder Smoothness 1 Mil
- Pencil Hardness 2H+
- Flexibility 1/8 in Diameter - No Fracture
- Salt Spray ASTM-B117 1000 Hours - Pass
- Humidity ASTM-02247 1000 Hours - Pass
- Adhesion, Crosshatch - 5B
- Gloss 90+ @ 60°

Standard Colors



Custom Colors

Custom Colors: Blue Star Power Systems, Inc. offers custom color options for your generator set enclosure. Cardinal is licensed by PANTONE® to accurately simulate both the PANTONE MATCHING SYSTEM® colors and the PANTONE® Textile Color System® with our powder and liquid coatings. Additional Charges apply.



Sub-Base Fuel Tanks

Blue Star Power Systems, Inc. provides either Diamond Vogel Nexgen Technology Paint or Cardinal Industrial Hammer Textured Semi-Gloss Polyester Powder Coat on all of our sub-base fuel tanks. Nexgen and Cardinal Industrial both offer excellent coverage and performance characteristics. Nexgen and Cardinal Industrial both exceed UL requirements.

Performance Characteristics

- 3.0+ Mils TDFT
- Xenon Arc 1100 Hours
- 500 Hour Salt Spray - Over Primer - Passed (3.0 Mils Total TDFT)
- Adhesion Crosshatch - 5B
- Gloss 90+ @ 60°

Standard Color



Blue Star Power Systems, Inc. enclosures are specifically designed for optimal protection against the elements. They are designed to protect the entire system from even the most extreme environments, and to reduce sound levels to most specified requirements. Blue Star Power Systems, Inc.'s vast flexibility allows the design of standard enclosures to meet most specifications or requirements. All standard enclosure models are constructed of 14 gauge steel and feature a pitched roof for increased structural integrity and superior watershed. All enclosures feature a rugged UL listed hammer powder coat finish as standard for a long lasting and durable finish in standard white or gray. Custom colors are available as specified.

Enclosure Design Features

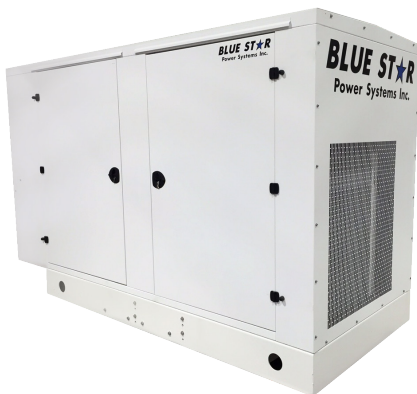


- UL 2200 & CSA Listed as standard
- All enclosure models are 200 MPH wind rating certified in accordance with IBC2018 and ASCE/SEI 7-16 standards.
- Lockable gasketed doors with draw down latches and Stainless Steel component hinges
- All Stainless Steel fasteners
- UL & CSA listed extreme-wear hammer powder coat finish
- Pitched roof for high structural integrity and superior watershed
- Above-door drip guards
- Optimal airflow means no cooling system de-rates on most models
- Internally mounted exhaust silencers standard up to 600 kWE
- Sound attenuation options
- Stainless Steel and Aluminum enclosure options

Level 1

Weather Proof Enclosure

Blue Star Power Systems, Inc. Level 1 enclosures have the rugged construction and weather proof protection required for most outdoor environments. These enclosures will effectively protect the gen-set through high wind (200 MPH), rain, snow, and other extreme weather conditions. Weather proof enclosures feature standard hinged lockable doors, a pitched roof to prevent water accumulation and improved structural integrity. The enclosure is painted with extreme-wear UL and CSA listed hammer powder coat finish.



Level 2

Weather Proof Enclosure with Foam

Blue Star Power Systems, Inc. Level 2 enclosures include all of the same great features of the Level 1 enclosures, and include even more. With the addition of high performance 1.5" Type D Sound Attenuating Foam, our Level 2 Enclosures offer an even lower dBA rating with the same great weather proof protection.

Level 3

Sound Attenuated Enclosure

Blue Star Power Systems, Inc. Level 3 enclosures feature the same great weather proof protection and standard features as the Level 1 & 2 enclosure models, but with a greater emphasis on reducing sound levels. Standard Level 3 features include the same high performance 1.5" type D sound attenuating foam, and also feature the addition of a separate frontal exhaust sound chamber and dual rear air intake to ensure that your system runs exceptionally quiet. These features make this enclosure among the best in the industry for noise reduction and quality.



Sound Attenuation Foam



Polydamp® Type D Acoustical Foam, (PAF) is an acoustical grade, open cell, flexible ether based urethane foam designed to give maximum sound absorption for a given thickness. It has excellent resistance to heat, moisture and chemicals. All applications use 1.5" foam as standard.



Foam Characteristics Sound Absorption: Nominal values of random incidence sound absorption coefficient per ASTM C384-77 for Plain/Tuffylm

Foam Thickness	125	250	500	1000	2000	4000
(1.5 in) 38.1 mm	15/20	27/49	60/96	77/93	90/82	98/67
(2.0 in) 50.8 mm	20/30	40/66	90/98	100/96	96/85	100/75

	Test Standard	U.S. Standard
Density, Nominal: (lb/ft3-kg/m3)	ASTM-D-3574-91	1.85
Tensile Strength: (PSI-KPa)	ASTM-D-3574-91	12
Elongation, %	ASTM-D-3574-91	120
Tear Resistance: (lb/in - N/M)	ASTM-D-3574-91	1.3
IFD: (PSI - KN/M2)	ASTM-D-3574-91	30
Compression Set (50%): %	ASTM-D-3574-91	10
Air Permeability (Tested at 1" thickness): (Rayles/M)	ASTM C-522	
Thermal Conductivity		
(BTU/hr. ft2, °F/in.)	ASTM C-177	0.25

Service Temperature	
Continuous	-45°F (-43°C) TO 212°F (100°C)
Intermittent	250°F (121°C)
Flame Resistance	
UL94	HF-1
FAR.853(B)	PASS
SAEJ-369(B)	PASS
MVSS-302	PASS
DIN	PASS
Humidity Resistance	
Excellent; no significant decrease in tensile strength or elongation after 5 hrs. of steam autoclave at 250°F (121°C) per ASTM D3574-86, Test J.	
Chemical Resistance	
Excellent - no significant change in strength after 4 weeks immersion in common solvents, alkalies, acids, and water.	
Estimated Service Life:	
Min. 10 years at 80F (27°C) and 95% R.H.	

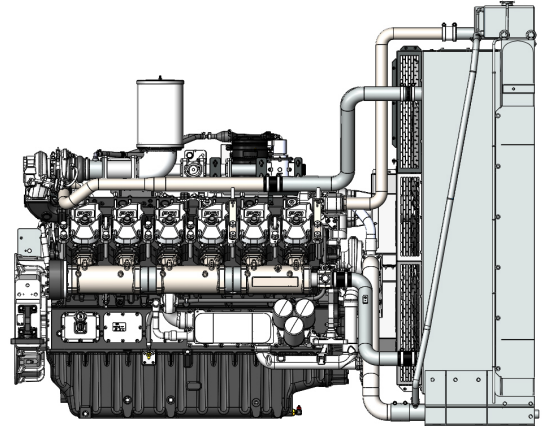
Adhesive Characteristics

P4 is a high performance unsupported acrylic pressure sensitive adhesive exhibiting aggressive tack, high peel and shear, and good heat resistance. In addition, it has good chemical and plasticizer resistance as well as excellent long term aging and the ability to withstand environmental extremes.

Adhesive Thickness (Nominal)	0.004"
Color of Adhesive	Water Clear
Release Liner	76 lb Polycoated bleached kraft paper
Service Temperature	-40°F +200°F

Radiators

Blue Star Power Systems, Inc. radiators offer a variety of styles and configurations including radiator and charged air assemblies, radiator and aftercooler assemblies with durable core construction. Our radiators are compact and efficient meeting the most stringent enclosure footprint requirements. All radiators are sized for 50°C (122°F) ambient. The single-source design ensures a perfect match with your generator set package.



Radiator Features

Standard Radiator Package

- Engine-specific tank design with variant coolant connection locations and sizes (dependant on engine size)
- Complete cooling package with mounting foot and plumbing kit
- All steel construction of top and bottom tanks
- Dual Core designs -
 - Jacket Water / Charged Air Circuit
 - Jacket Water / After Cooler Circuit
- Individual radiators designed to meet manufacturer's specific requirements
- Top tank has built in expansion capacity - no need for an external recover tank
- Full or partial deration system built into the top tank
- Standard cooling package includes fan shroud & fan guard
- Corrosion preventive options:
 - Hot dipped galvanizing on all steel parts or stainless steel
 - Epoxy coated cores

Fan-On Radiator Design

- Engine-specific tank design with variant coolant connection locations and sizes (dependant on engine size)
- Rigid built construction for fan support
- High speed bearings within pillow blocks
- Dual Core designs with variable jacket water / after cooler circuit designs
- All steel construction of top and bottom tanks
- Individual radiators designed to meet manufacturer's specific requirements

Circuit Breakers



Blue Star Power Systems, Inc. MC (Molded Case) Series Circuit Breakers are the highest quality in the industry. They will protect the power system and corresponding equipment from damaging fault currents circuits and overloads.

80% Rated Circuit Breakers

80% rated breakers can only be applied continuously at 80% of the rated breaker. Tripping of the circuit breaker if the current goes above 80% will depend on the amount of current and the duration.

100% Rated Circuit Breakers

100% rated breakers can be applied at 100% of their current rating continuously.

Accessories

Shunt Trip - Provides a means of tripping the circuit breaker from a remote source by energizing a solenoid in the breaker. This can be achieved through the panel faults such as engine shutdowns, overcurrent, etc. The circuit breaker will have to be reset locally in the event of a tripped breaker.

Bell Alarm / Alarm Switch - Provides remote indication of whether the circuit breaker is in a tripped position. The bell alarm will remain unchanged during on-off operations and during operation by the Push-to-Trip button on the circuit breaker.

Auxiliary Switch/Contacts - Provides remote indication of whether the circuit breaker is in an open or closed state.

Ground Fault Indication/Alarm - Adjustable relay that indicates a ground fault condition with adjustable time delay.

Trip Unit

LI Breakers - Includes adjustable Long-Time pickup and delay and adjustable Instantaneous pickup.

LSI Breakers - Includes features of LI Breakers with addition of Short-Time pickup and delay.



Breaker Model	Amperage	Percentage Rated	Maximum Voltage Rating (AC)	UL Listed Interrupting Rating (kA)			Lug Qty. and Size (Cu & Al)
				240	480	600	
H-Frame	15-150	80% or 100%	600	25	18	14	(1) #14-3/0
Q-Frame	70-250	80%	240	10	-	-	(1) #4-300 kcmil
J-Frame	150-175	80% or 100%	600	25	18	14	(1) #4-4/0
	200-250						(1) 3/0-350 kcmil
L-Frame	125-400	80% or 100%	600	65	35	18	(2) 2/0-500 kcmil
	200-600	80%	600				
M-Frame	300-800	80%	600	65	35	18	(3) 3/0-500 kcmil

Breaker Model	Frame Size	Percentage Rated	Maximum Voltage Rating (AC)	UL Listed Interrupting Rating (kA)			Lug Qty. and Size (Cu & Al)
				240	480	600	
P-Frame	600	80% or 100%	600	65	35	18	(3) 3/0-500 kcmil
	800						(3) 3/0-500 kcmil
	1000						(4) 3/0-500 kcmil
	1200						(4) 3/0-500 kcmil
R-Frame (LSI Standard)	1600	100%	600	65	35	18	(12) 3/0-750 kcmil
	2000						(15) 3/0-750 kcmil
	2500						(18) 3/0-750 kcmil
	3000						(21) 3/0-750 kcmil

CB / CL Series Engine Block Heaters



Features

- ▶ Constant circulation of coolant through the engine achieves even heat distribution
- ▶ One-piece, heavy-duty, pressure die-cast aluminum tank with a bolt-on flange element assembly
- ▶ Fixed thermostat ON: 100°F, OFF: 120°F (optional temp ranges available)
- ▶ All parts replaceable - easy to service
- ▶ CSA and cULus approved
- ▶ Classified weather tight
- ▶ Models available for Class I, Group D (Hazardous Locations) applications
- ▶ Various voltages and 3 phase units available



▶ Easy Starts

- ▶ Saves warm-up time
- ▶ Saves fuel
- ▶ Prolongs battery life
- ▶ Protects the Environment
- ▶ Reduces “white smoke” upon start-up
- ▶ Engine is ready for full power operation
- ▶ Reduces noise pollution

Reduces Engine Wear

- ▶ 90% of engine wear is due to low jacket water temp upon start-up
- ▶ Stops destructive condensation
- ▶ Extends engine life

Specifications

Part Number	Volts	Watts	Phase	Amps
10591	120	2500	1	20.8
11376	208	2500	1	12.0
10592	240	2500	1	10.4
14208	480	2500	1	5.2
11136	120	3000	1	25.0
11137	208	3000	1	14.4
10593	240	3000	1	12.5
11138	480	3000	1	6.3
11139	208	4000	1	19.2
10594	240	4000	1	16.7
11140	480	4000	1	8.3
11141	208	5000	1	24.0
10595	240	5000	1	20.8
11142	480	5000	1	10.4

Single Stage Air Cleaner



Single Stage Air Cleaners are tough, non-metallic, lightweight, self-supporting and completely disposable. They are also easy to install, durable, and reliable. They are designed to function well under high and severe pulsation conditions found in many applications. Vibration-resistant media is potted into molded housings of rugged ABS plastic – so they don't fall apart as other designs might. They can be mounted vertically or horizontally.



Specifications

- No serviceable parts - Air cleaner housing and filter are one unit
- Designed to withstand severe intake pulsation
- Economical replacement cost
- Self-supporting, sturdy
- Very reliable: only one critical seal
- Lightweight and compact in size
- Non-metallic, non-corrosive
- Completely disposable - acceptable for normal trash pick-up (should not be incinerated)
- Easily installed and maintained
- Minimal removal clearance needed: only 1.5"
- Three airflow styles available to fit virtually any engine intake configuration
- Various media available for specific generator set applications: high pulsation, high humidity, etc.
- Temperature tolerance: 180°F/83°C continuous 220°F/105°C intermittent

CPJ Series Critical Grade Silencers



Blue Star Power Systems, Inc. "CPJ" Series is the accumulation of research and development offering a compact silencer without compromising performance. It incorporates a unique combination of resonator chambers, acoustically packed internal components and diffusers to achieve a stunning level of performance for its size. All CPJ series silencers are critical grade silencers and are packed with insulation to greatly reduce radiated noise and exterior shell temperature.

Standard Construction Features

- Available in sizes from 2 inch to 12 inch
- Multitude of inlet/outlet design styles to meet almost any requirement
- Packed with fiberglass insulation to reduce shell temperature and noise levels
- Fully welded double shell carbon steel weldment construction, corrosive resistant
- High density fiberglass acoustic blanket good to 1500°F, wrapped with 304 Stainless Steel wire mesh cloth and encased in a carbon steel perforated facing
- Black phenolic resin based finish paint



Optional Construction Features and Accessories

- Stainless Steel construction
- Aluminum construction
- Aluminized Steel construction
- Vertical mounting legs
- Round mounting bands
- Horizontal mounting saddles
- Horizontal and vertical shell lugs
- Special finish per specification
- Air leak test
- ASME code construction
- Oversized flanges
- Acoustic shell lagging
- High temperature acoustic pack material
- Contact factory for additional features to meet your requirements

Model #	Part #	Outlet Size	Flanged Connection	WT (lbs)
CPJS-02	10660	2.0" OD	No	12
CPJS-25	10661	2.5" OD	No	18
CPJS-03	10662	3.0" OD	No	20
CPJS-35	10663	3.5" OD	No	30
CPJS-04	10664	4.0" OD	No	31
CPJS-05	10665	5.0" OD	No	50
CPJS-06	10666	6.0" OD	Yes	50
CPJS-08	10667	8.0" OD	Yes	120
CPJS-10	10668	10.0" OD	Yes	180

Engine Starting Batteries

Blistering heat and bitter cold are ruthless battery killers. That's why Blue Star Power Systems, Inc. utilizes a pioneered climatized battery. Designed to offer you long-life and high-performance starting power that will get your gen-set running even under extreme conditions. Blue Star Power Systems, Inc. "all-climate" batteries stand up to the harshest temperatures and are available in sizes and configurations to fit almost any application.



Standard Features

- Unique Manifold Vent - Virtually eliminates corrosion by venting gases away from terminals and cables
- Exclusive TRP™ Construction – Rib reinforced TRP™ container significantly improves the vibration and impact resistance
- Armored Plate Cell Bonding - Vibration is the number one killer of commercial batteries. To solve this problem, the cells of every battery are bonded
- Polyethylene Enveloped Separator Design – Super tough polyethylene material reduces electrical resistance and provides higher cranking performance
- Center Lug Design - Suppresses the vibration inherent in traditional construction for improved performance (where applicable)
- TTP™ - Through-the-Partition inter-cell connectors create a shorter current path to deliver more power to the terminals
- Heavy Duty Cases - Reinforced polyethylene or hard rubber cases stand up to the demands of standby gen-sets
- Convenient Lifting Slots - a handle is built in the top of the battery for easy carrying and transportation
- Protective Bottom Design - Waffled bottom design provides protection against nuts, bolts, or stones that might become lodged under the battery
- Computer Designed Radical Grids - An improved state-of-the-art design which adds power and resists vibration
- Threaded Accessory Ports - Features a sealed "O" ring that does not work loose during severe service (78DT only)

Specifications

BCI Group Size	NEMA Type			Dimensions (Inches)			
	Part Number	CCA at 0°F	CCA at 32°F	Length	Width	Height	Weight (lbs.)
78DT	78DT-HD	800	960	10-11/16	7-1/16	8-1/8	54
4D	4D-HD	1000	1200	19-9/16	8-5/16	10	95
8D	8D-HD	1300	1560	20-3/4	11	10	117

BC2405A Series Battery Chargers



The BC2405A charger is built to stand up to the punishing power generation environment. It is engineered to exacting performance specifications, including cULus listing for an extra margin of safety.

Features

- Automatic 24V 5A, 2-Stage charge rate
- UL 1236 listed
- Watertight, shock proof and corrosion proof
- LED status indicators
- Reverse polarity protected
- Short circuit protected
- EMI/RFI Shielded



Specifications

Specifications

Output Voltage: 24VDC

Input Rating

Input Voltage Range: 100 - 130VAC

Input Current Rating: 3.0A maximum

Float - Maintenance Stage

Float Voltage: 27.1VDC

Float Current: 0.1A

LED Status: Green LED On

Full Load - Bulk Stage

Full Load Voltage: 24.0 - 27.1VDC

Full Load Current: 0.1 - 5.0A

LED Status: Red LED On

Reverse Polarity Protection

Available as Standard: Yes

Short Circuit / Overload Protection

Maximum Short Circuit Current: 8A (typical)

Current Limit: 7A (+/- 10%)

Operating Temperature Range

Minimum Temperature: -40° C

Maximum Temperature: 50° C

Agency Certification

This product is listed under UL 1236 for battery chargers.

Warranty

Warranty Period: 1 Year

Weight: 4.5 Pounds

Sub-Base Fuel Tanks



Blue Star Power Systems, Inc. sub-base fuel tanks are listed and manufactured under UL 142 & ULC-S601 standards for steel above ground tanks, which guarantees that every fuel tank meets the structural and mechanical integrity requirements for mounting a generator set directly on top of the tank. This provides a convenient, efficient, and safe way to store fuel for your generator set.



Sub-Base Fuel Tank Standard Features

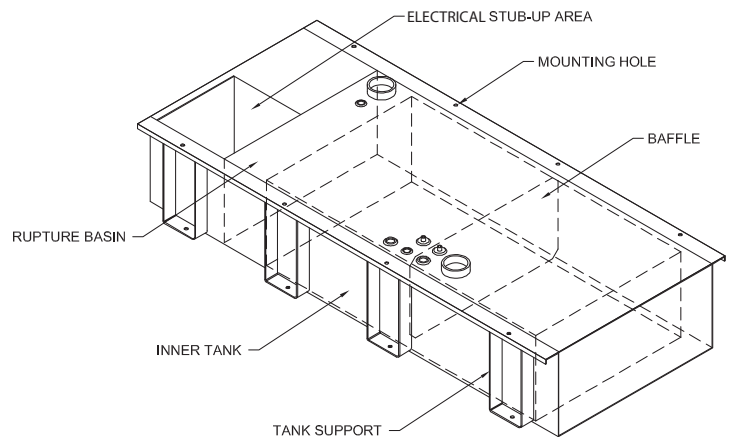
- Double walled secondary containment UL 142 & ULC-S601 Listed
- Electrical stub-up openings are standard to provide generator set wiring provisions through the base tank
- Heavy gauge steel construction
- Diamond Vogel Nexgen Technology Paint or Cardinal Industrial Hammer Textured Semi-Gloss Polyester Powder Coat
- Standard fittings: fuel supply with check valve (sized per unit), fuel return (sized per unit), 2" NPT for normal vent, 2" - 6" NPT for emergency vent (sized per unit), 2" NPT for manual fill, 1 1/2" NPT for fuel level gauge, and 3/8" NPT basin drain (plugged). Removable 1/2" supply dip tube standard (size may vary with gen-set model). 1 1/2" NPT for leak detection
- Interior tank baffle: Separates cold engine supply fuel from hot returning fuel
- Direct reading fuel level gauge
- Low fuel level and fuel leak alarms

Design Options

- High and critical low fuel level shutdowns or alarms
- Full pumping control systems for a true day tank system with a full array of electrical options
- Additional Tank Fittings
- Custom Fuel Tank Designs (sizes and shapes)
- Fuel Heater
- Fill / Spill Containment

Blue Star Power Systems, Inc. offers two distinctive types of double wall sub-base fuel tanks, those with an electrical stub up area (standard) and those without. Each type can be customized to any specification to meet your specific requirements.

UL 142 & ULC-S601 double wall secondary containment sub-base fuel tank with stub-up.



Factory Load Test

Blue Star Power Systems, Inc. factory testing is performed with the same extreme diligence and attention to detail that is given to the prototype testing process. Every engine generator set receives a complete factory load test that certifies and ensures that the set will function in accordance to every specific application. Test metering will have an accuracy of 1.3% or better. This metering equipment is calibrated annually, and is directly traceable to the National Institution of Standards & Technology (NIST). All test procedures are conducted in accordance with MIL-STD-705C where applicable.



Factory Acceptance Testing Procedures

- Insulation Resistance Test (301.1c)*
- High Potential Test (302.1b)*
- Alternator Over Speed
- Complete Engine Inspection
- Generator Inspection
 - Winding Resistance Test (401.1b)
 - Exciter Field Stator
 - Main Field Stator
- Mounting & Coupling Inspection
- Engine Fuel System Inspection
- Engine Lube Oil System Inspection
- Engine Cooling System Inspection
- DC Charging System Inspection
- Main Output Circuit Breaker Inspection
- Anticipatory Alarms and Shutdowns Test (505.2b, 515.1b, 515.2b)
- Optional Equipment Inspection (513.2a)
- Load Test (640.1d)
 - Regulator Range Test (511.1d)
 - No Load
 - MAX Load @ 1.0 P.F. (640.2d)
 - MAX Load @ 0.8 P.F.
 - Block Loads @ 0-25%, 0-50%, 0-75%, 0-100% of rated load tests (640.2d)
- 1.0 Power Factor Max Load
- 1.0 Power Factor Max Block Load Pickup
- Full Name Plate Rated Load.
- Standard Readings Taken Every 5 Minutes.

* Performed By Alternator OEM

Standard Reading Recorded During Load Test Inspection

Run Time	AC Frequency
AC Voltage	Exciter Field Voltage
AC Amperage	Exciter Field Current
kVA	Lube Oil Pressure
kWe	Engine Coolant Temp.
Power Factor	Ambient Temp.

Factory Load Test Summary

All engine generator sets are visually inspected prior to testing. This includes a complete visual/mechanical inspection to ensure that all fasteners and electrical connections are secure, that all rotating components are free of obstruction/interference and are properly guarded.

Once the unit is started, the AC voltage and frequency are set to rated values. The unit is operated at no load while all of the safety shutdowns and warnings are verified and tested. The unit is then restarted and run at 25%, 50% and 100% of rated load and power factor until the engine temperature has stabilized for at least ten minutes. During the rated and maximum load pickup portion of the test, the voltage regulator gain, stability and under frequency compensation adjustments are set for optimal performance. All test procedures are performed in accordance with MIL-STD-705C where applicable.

Throughout these test procedures the AC parameters, engine oil pressure, engine temperature, exhaust temperature, timing and air/fuel ratio (gaseous units) are monitored and recorded. The unit and all installed accessory equipment are continually examined for oil and coolant leaks, excessive vibration and foreign noises.

Once all test procedures are performed and recorded, the unit is allowed a cool down period prior to being shut down. The unit is once again inspected for leaks, loose fasteners and connections prior to leaving the test facility.

The unit receives another complete final inspection process prior to packaging and shipment.

Note: All units are tested after the painting process is complete to prevent unforeseen difficulties resulting from the painting process being performed after testing.

Witnessed Factory Load Test

Standard witnessed factory load testing must be scheduled and approved at least four weeks prior to the engine generator sets scheduled shipping date. Any requests for witnessed factory load testing after this four week period may incur additional charges.

Witnessed Extended Run Factory Load Test

Witnessed extended run factory load testing must be scheduled and approved at the time of order placement. Any requests for witnessed extended run factory load testing after this time could be denied and would if approved incur additional cost.

All units are built and tested to cUL, CSA and NFPA 110 standards.



Engine Generator Set Two (2) Year 2000 Hour Standby Limited Warranty



Your Blue Star Power Systems, Inc. product has been designed and manufactured with care by people with many years of experience. Blue Star Power Systems, Inc. warrants to its Buyer that the product is free from defects in materials and/or workmanship for the period of time outlined below. If the product should prove defective within the time period outlined below, it will be repaired, adjusted or replaced at the option of Blue Star Power Systems, Inc., provided that the product, upon inspection by Blue Star Power Systems, Inc., has been properly installed, maintained and operated in accordance with Blue Star Power Systems, Inc.'s Installation and Operating Manuals. This limited warranty is not valid or enforceable unless: (1) all supporting maintenance records are kept on file with the end user and made available upon request from factory, and (2) the generator set is routinely exercised in accordance with operating instructions. This warranty does not apply to malfunctions caused by physical damage, misuse, improper installation, repair or service by unauthorized persons, or normal wear and tear. The warranty is not assignable.

Blue Star Power Systems, Inc. product warranty period: Engine generator set: Parts and Labor for two (2) years from the date of factory invoice or 2000 hours (whichever occurs first). Accessories (installed on the engine generator set or shipped loose): Parts and Labor for one (1) year from the date of factory invoice or 2000 hours (whichever occurs first). Transfer Switches: If purchased with a generator set (same order number): Parts and Labor for two (2) years from the date of factory invoice or 2000 hours (whichever occurs first).

The start of the warranty period can be adjusted to the date of unit start-up (limited to 180 days from invoice date) provided that the following information is provided to Blue Star Power Systems, Inc. within 30 days of start-up. The warranty will not be effective unless a copy of the Blue Star Power Systems, Inc. start-up validation checklist is properly and completely filled out and returned to Blue Star Power Systems, Inc. within 30 days of start-up. Additionally, the engine manufacturer's engine registration form must be completed and returned to the engine manufacturer as stated in the instructions with the registration form.

To obtain warranty service: Contact your nearest Blue Star Power Systems, Inc. Service Representative. For assistance in locating your nearest authorized service representative, contact Blue Star Power Systems, Inc., Attention: Service Department (see contact information below).

Warranty service may be performed by authorized Blue Star Power Systems, Inc. service providers only. Service work performed by unauthorized persons will void all warranties.

Blue Star Power Systems, Inc. shall not be liable for any claim in amount greater than the purchase price of the product. In no event shall Blue Star Power Systems, Inc. be held liable for any special, indirect, consequential or liquidated damages including but not limited to: loss of profits, loss of time, increased overhead, delays, loss of business opportunity, good will, or any commercial or economic loss.

Blue Star Power Systems, Inc. shall not be liable for any claim that requires replacement of engine, part, or component of the gen-set that is no longer manufactured or available. Additionally, Blue Star Power Systems, Inc. will not be liable for any engine replacement that may require emissions tier level change.

THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE DESCRIBED HEREIN. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, OR OTHERWISE CREATED UNDER THE UNIFORM COMMERCIAL CODE, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY, OR WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE.

The following items and/or circumstances are excluded from this limited warranty:

- ▶ Engine starting batteries: The battery manufacturers' warranty applies. Consult your local battery supplier for warranty service.
- ▶ Fuel system and/or governing system adjustments performed during or after start-up.
- ▶ Normal maintenance items: Consumable items such as belts, filters, fluids, and hoses.
- ▶ Adjustments and tune-ups performed during start-up or thereafter. Start-up, training, tuning, and adjustments for any paralleling or bi-fuel system.
- ▶ Loose connections (electrical and mechanical) not found during start-up.
- ▶ All fluid level related items including low coolant not found during start-up or checked during regular maintenance intervals.
- ▶ Shipping damage of any type. All equipment is shipped F.O.B. Blue Star Power Systems, Inc. and risk of loss transfers to the carrier once loaded for shipment. It is the responsibility of the receiving party to sign for the receipt of, and note any shipping damage to the equipment. Freight damage claim filing is the responsibility of the receiving party. In the rare event that damage occurs during shipment, Blue Star Power Systems, Inc. will not warrant any damage to the unit resulting from shrink wrap.
- ▶ Any special access fees, equipment, requirements or after hours scheduling to gain access to the equipment for warranty service purposes.
- ▶ Buyer requested rental generators used while warranty work is being performed.
- ▶ Damages caused by acts of nature, such as lightning, wind, flood, or earthquake.
- ▶ Any damage due to situations beyond the control of the manufacturing and/or workmanship of the product.
- ▶ Use of non-protected steel enclosure within 10 miles of the coast.
- ▶ Improper installation or operation as outlined in the Installation and Operation Manuals.
- ▶ Misapplication of the equipment such as usage outside the original design parameters as stated on the nameplate of the equipment.
- ▶ Equipment purchased at the standby rating that is being used in a prime power application(s).
- ▶ Diesel engine "Wet Stacking" or Regeneration issues due to lightly loaded diesel engines.
- ▶ Travel labor and mileage for mobile generator sets.
- ▶ More than one trip to the job site because a service vehicle was not stocked with normal service parts.
- ▶ Lodging expense associated with unit repair and excessive mileage charges (limit to 300 miles round trip from nearest service center).
- ▶ Failure to properly exercise and maintain your equipment per manufacturer's specifications will void all warranty.
- ▶ Equipment modifications made without the written consent of Blue Star Power Systems, Inc. will void all warranties.
- ▶ Any equipment or components added including fuel tanks and enclosures not installed at the Blue Star Power Systems, Inc. factory.

This agreement is deemed made and executed in North Mankato, Nicollet County, Minnesota and shall be construed and interpreted in accordance with the laws of the state of Minnesota without giving effect to its conflicts of laws principals. Each of the parties submits to the exclusive personal jurisdiction and venue with respect to any action or proceeding arising out of, in connection with, relating to, or by reason of this agreement before the district court of the state of Minnesota, located in Nicollet County and agrees that all claims in respect of the action or proceeding may be heard and determined in any such court.